

We claim:

1. A method of adhering a biomolecule to a substrate, comprising treating the substrate with 1) a surfactant compound and 2) a biomolecule.

2. The method of claim 1 wherein the surfactant compound is not covalently linked to the substrate.

Sub a1
3. The method of claim 1 or 2 wherein the surfactant compound comprises one or more hydrophobic regions and one or more hydrophilic regions.

4. The method of any one of claims 1 through 3 wherein the surfactant compound comprises one or more hetero atoms.

5. The method of any one of claims 1 through 4 wherein the surfactant compound comprises one or more alkoxy groups.

6. The method of any one of claims 1 through 5 wherein the surfactant is a polymeric material.

7. The method of any one of claims 1 through 6 wherein the surfactant has a molecular weight of at least about 1,000.

8. The method of any one of claims 1 through 7 wherein the surfactant is a polyalkyl oxide.

Sub a2
9. The method of any one of claims 1 through 8 wherein the surfactant comprises polyethylene oxide units.

10. The method of any one of claims 1 through 9 wherein the surfactant comprises polyC₃₋₂₀alkyl oxide units.

11. The method of any one of claims 1 through 9 wherein the surfactant comprises polyC₃₋₁₂alkyl oxide units.

12. The method of any one of claims 1 through 9 wherein the surfactant comprises polypropylene oxide units.

Surf 3
13. The method of any one of claims 1 through 12 wherein the surfactant comprises thiol groups.

14. The method of any one of claims 1 through 12 wherein the surfactant comprises alkylthio groups.

15. The method of any one of claims 1 through 14 wherein the surfactant comprises charged or chargeable groups.

16. The method of any one of claims 1 through 12 wherein the surfactant is a Pluronic or Tween material.

Surf 4
17. The method of any one of claims 1 through 17 wherein the surfactant is in a defined patterned on the substrate, with selective substrate areas bared of the surfactant.

18. The method of any one of claims 1 through 17 wherein the biomolecule resides on substrate areas bared of the surfactant.

19. The method of any one of claims 1 through 18 wherein an applied layer of the surfactant is exposed to patterned radiation to define a desired pattern of the surfactant layer.

20. The method of claim 19 wherein the biomolecule selectively adheres to substrate regions bared of the surfactant through the exposure.

21. The method of any one of claims 1 through 20 wherein a network of microchannels positioned on the substrate define selected areas of deposition of the biomolecule.

22. The method of any one of claims 1 through 16 wherein a selected pattern of the surfactant or biomolecule is defined by physical treatment of the substrate.

23. The method of claim 22 wherein the physical treatment comprises a stamping process, microfluidics, photolithography, microcontact printing, nanopen lithography, subtraction active devices or eletrophoresis.

Sub 25 24. The method of any one of claims 1 through 23 wherein the substrate is treated with a binding agent prior to treating with the biomolecule.

25. The method of claim 24 wherein the binding agent comprises a protein.

26. The method of any one of claims 1 through 25 wherein the biomolecule is selected from peptides, polypeptides, nucleic acids, nucleic acid binding partners, proteins, receptors, antibodies, enzymes, carbohydrates, oligo saccharides, polysaccharides, cells, cell aggregagates, cell components, lipids, arrays of ligands (e.g. non-protein ligands), liposomes, or microorganisms, e.g., bacteria, viruses.

Sub 26 27. The method of claim 24 or 25 wherein cells bind to the binding agent.

28. The method of claim 27 wherein the cells comprise bacterial cells, mammalian cells such as chinese hamster ovary (CHO), baby hamster kidney (BHK), COS, human fibroblast, hematopoietic stem cells, hepatocytes, and hybridoma cell lines; yeast; fungi; and cell lines useful for expression systems such as yeast or *Xenopus laevis* oocytes.

29. The method of claims 1-28, further comprising providing at least one additional and different biomolecule.

30. The method of any one of claims 1 through 29 wherein the substrate surface comprises a polymer.

31. The method of any one of claims 1 through 30 wherein the substrate surface comprise glass.

32. A method of adhering a biomolecule to a substrate, comprising:

- a) providing a binding agent onto a template having a desired pattern;
- b) contacting the template with the substrate so that the binding agent is transferred to the substrate in a pattern corresponding to the template;
- c) providing a non-adhesive agent to the substrate having the binding agent pattern thereon, wherein the non-adhesive agent adheres to the substrate area not comprising the binding agent;
- d) providing biomolecules to the substrate, wherein the biomolecules adhere to the binding agent but not the non-adhesive agent.

33. The method of claim 32 wherein the binding agent comprises a protein capable of adhering to the biomolecule.

34. The method of claim 32 or 33 wherein the non-adhesive agent comprises a surfactant compound.

35. The method of any one of claims 32 through 34 wherein the biomolecule are cells.

36. The method of claims 32 through 35, further comprising providing at least one additional and different biomolecule.

37. A method of adhering a biomolecule to a substrate comprising:

- a) providing a surfactant onto template;
- b) contacting the template with the substrate so that the surfactant is transferred to the substrate in a pattern corresponding to the template;
- c) providing a binding agent to the substrate having the surfactant pattern thereon, wherein the binding agent adheres to the substrate area not comprising the surfactant;
- d) providing a non-adhesive agent to the surface having the pattern of hydrophilic and hydrophobic agents thereon;
- e) providing a binding agent, wherein the binding agent binds to the hydrophilic agent;
- f) providing biomolecules to the surface, wherein the biomolecules adhere to binding agent but not the non-adhesive agent.

38. The method of claim 37 wherein the binding agent comprises a protein capable of adhering to the biomolecule.

39. The method of any one of claims 36 and 37 wherein the biomolecule is a cell.

40. The method of any one of claims 36 through 39, further comprising providing at least one additional and different biomolecule.

41. A method of patterning a surface with biomolecules comprising:

- a) providing a mask to the surface, wherein the mask has a desired pattern of open areas and closed areas;
 - b) providing a non-adhesive agent to the surface;
 - c) providing a binding agent;
 - d) providing biomolecules to the surface;
- wherein the biomolecules adhere to binding agent but not the non-adhesive agent.

42. The method of claim 41 wherein the binding agent comprises a protein capable of adhering to the biomolecule.

43. The method of claim 41 or 42 wherein the non-adhesive agent comprises a surfactant compound.

44. The method of any one of claims 41 through 43 wherein the biomolecule is a cell.

45. The method of claims 41 through 44, further comprising providing at least one additional and different biomolecule.

46. A device for adhering a biomolecule in a predetermined position comprising:

a substrate having thereon a plurality of cytophilic regions that can adhere a biomolecule on the substrate by cytophobic regions to which the biomolecules do not adhere contiguous with the cytophilic regions,
wherein the cytophobic regions comprise one or more surfactant compounds.

47. The device of claim 46 wherein the surfactant compound is not covalently linked to the substrate.

48. The device of claim 46 or 47 wherein the surfactant compound comprises one or more hydrophobic regions and one or more hydrophilic regions.

49. The device of any one of claims 46 through 48 wherein the surfactant compound comprises one or more hetero atoms.

50. The device of any one of claims 46 through 48 wherein the surfactant compound comprises one or more alkoxy groups.

51. The device of any one of claims 46 through 50 wherein the surfactant is a polymeric material.

52. The device of any one of claims 46 through 51 wherein the surfactant has a molecular weight of at least about 1,000.

53. The device of any one of claims 46 through 51 wherein the surfactant has a molecular weight of at least about 10,000.

54. The device of any one of claims 46 through 53 wherein the surfactant comprises polyethylene oxide units.

55. The device of any one of claims 46 through 54 wherein the surfactant comprises polyC₃₋₂₀alkyl oxide units.

56. The device of any one of claims 46 through 54 wherein the surfactant comprises polypropylene oxide units.

57. The device of any one of claims 46 through 56 wherein the surfactant comprises thiol groups.

58. The device of any one of claims 46 through 56 wherein the surfactant comprises alkylthio groups.

59. The device of any one of claims 46 through 58 wherein the surfactant comprises charged or chargeable groups.

60. The device of any one of claims 46 through 56 wherein the surfactant is a Pluronic or Tween material.

61. The device of any one of claims 46 through 60 wherein the substrate is a microarray substrate.

62. The device of any one of claims 46 through 61 wherein the substrate comprises at least 1 million biomolecules per cm^2 .

63. The device of any one of claims 46 through 61 wherein the substrate comprises at least 2 million biomolecules per cm^2 .

7/11/01